CLAIMS

What is claimed is:

1. A system that facilitates non-invasive in-line characterization of parameters of VLSI circuit interconnects, comprising:

a plurality of micro-electro-mechanical system (MEMS) cantilevers that apply voltage(s) to VLSI circuit interconnect(s) without physical contact thereto;

a measuring component that measures deflection characteristics of the cantilevers, the deflection(s) correspond to electrical forces generated from the applied voltage(s) as passed through VLSI circuit interconnect(s); and

a component that computes characteristics of the VLSI interconnect based at least in part upon the measured deflection characteristics.

2. The system of claim 1, further comprising a control component that effectuates control of a VLSI circuit fabrication process step based at least in part upon the computed characteristics.

3. The system of claim 2, wherein the computed characteristics are employed as feedback information to the control component.

4. The system of claim 2, wherein the computed characteristics are employed as feed-forward information to the control component.

5. The system of claim 1, wherein the MEMS cantilevers comprise conductive tips to effectuate injection of voltages into the VLSI circuit interconnects.

6. The system of claim 5, wherein the MEMS cantilevers act as a conductive path to the conductive tips.

7. The system of claim 5, wherein a conductive path is provided on the MEMS cantilevers to the conductive tips to facilitate injection of currents ~~voltages~~ into the VLSI circuit interconnects.

8. The system of claim 1, further comprising test structures for capacitance and/or resistance measurement.

9. The system of claim 1, further comprising a voltage source that delivers voltages to the MEMS cantilevers, the voltage source delivering disparate voltages to disparate MEMS cantilevers.

10. The system of claim 1, wherein the measuring component comprising a ~~laser~~ photo-detector that detects a laser beam deflecting off at least one MEMS cantilever.

11. The system of claim 1, wherein the measuring component comprises an optical interferometer.

12. The system of claim 1, further comprising a positioning component that facilitates proper positioning of the MEMS cantilevers with respect to the VLSI circuit interconnects.

13. The system of claim 12, the position components being scanners.

14. The system of claim 1, further comprising a pre-amplifier.

15. The system of claim 1, further comprising an amplifier.

16. The system of claim 1, further comprising a tuning fork, wherein at least one MEMS cantilever is attached to the tuning fork.

17. The system of claim 17, wherein the tuning fork is a quartz tuning fork that can be at least one of self-sensing and self-actuating.

18. The system of claim 17, wherein an electrostatic shield is provided to shield a conductive path across the tuning fork to a conductive tip of the MEMS cantilever.

19. The system of claim 17, wherein a first leg of the MEMS cantilever is attached to a first prong of the tuning fork, and a second leg of the MEMS cantilever is attached to a second prong of the tuning fork.

20. The system of claim 1, wherein at least one MEMS cantilever is a piezo-resistive cantilever.

21. The system of claim 1 employed to measure coupling capacitance between VLSI circuit interconnects.

22. The system of claim 1 employed to measure capacitance between at least one VLSI circuit interconnect and a ground plane.

23. The system of claim 1, wherein the MEMS cantilevers and the VLSI circuit interconnects are within a vacuum chamber.

24. The system of claim 1 utilized to characterize at least one of resistance and capacitance of a transistor.

25. The system of claim 1, wherein a distance between VLSI circuit interconnects is less than 0.2 μm.

26. The system of claim 1, wherein a length of VLSI circuit interconnects is less than 10 μm.

27. The system of claim 1, wherein at least a portion of a first VLSI circuit interconnect to be tested is on a disparate layer compared to a second VLSI circuit interconnect to be tested.

28. The system of claim 1, wherein the VLSI circuit interconnects are covered by a layer of dielectric.

29. A system that facilitates characterization of VLSI circuit interconnects, comprising:

a voltage source that outputs a plurality of disparate voltages;

two or more micro-electro-mechanical system (MEMS) cantilevers that receive the voltages output by the voltage source and apply the voltage(s) to VLSI circuit interconnect(s), wherein a first MEMS cantilever contacts a first VLSI interconnect and a second MEMS cantilever does not physically contact a VLSI interconnect;

a measuring component that measures deflection characteristics of the cantilevers, the deflection(s) correspond to electrical forces generated from the applied voltage(s) as passed through VLSI circuit interconnect(s); and

a component that computes characteristics of the VLSI interconnect based at least in part upon the measured deflection characteristics.

30. The system of claim 30, wherein the computing component calculates a coupling capacitance between VLSI circuit interconnects based at least in part upon the measured deflection characteristics.

31. The system of claim 30, wherein the computing component calculates a capacitance of a VLSI circuit interconnect that is not contacted by the first MEMS cantilever with respect to ground.

32. A method that facilitates measurement of various parameters of VLSI circuit interconnects, comprising:

positioning at least two MEMS cantilevers with conductive tips in proximity to at least two adjacent VLSI circuit interconnects;

providing voltage(s) to the conductive tips;

injecting the current (s) into the VLSI circuit interconnects *via* the conductive tips;

measuring oscillations resultant in the MEMS cantilevers; and

computing capacitance related to the VLSI circuit interconnects based at least in part upon the measured oscillations.

33. The method of claim 33, further comprising computing coupling capacitance between the two adjacent VLSI circuit interconnects based at least in part upon the measured oscillations.

34. The method of claim 33, further comprising computing capacitance of at least one MEMS cantilever with respect to a ground plane in a substrate.

35. The method of claim 33, further comprising:

providing a first voltage to a first MEMS cantilever with a frequency substantially similar to one half of at least one of a natural resonant frequency and a user-selected frequency of the first MEMS cantilever; and

grounding a second MEMS cantilever.

36. The method of claim 33, further comprising:

providing a first voltage to a first MEMS cantilever with a frequency substantially similar to one half of at least one of a natural resonant frequency and a user-selected frequency of a second MEMS cantilever; and

grounding the second MEMS cantilever.

37. The method of claim 33, further comprising:

providing a first voltage to a first MEMS cantilever with a frequency substantially similar to bf_{res6}, wherein b ≥ 1.3 and f_{res6} is substantially similar to one half of at least one of a resonant frequency and a user-selected frequency of a second MEMS cantilever; and

providing a second voltage to the second MEMS cantilever with a frequency substantially similar to $f_{res5}(1+ab)$, wherein f_{res5} is substantially similar to half a resonant frequency of the first MEMS cantilever and a is substantially similar to f_{res5}/f_{res6}.

38. The method of claim 33, further comprising:

providing a first voltage to a first MEMS cantilever with a frequency substantially similar to bf_{res6}, wherein $b \geq 1.3$ and f_{res6} is substantially similar to one half of at least one of a resonant frequency and a user-selected frequency of a second MEMS cantilever; and

providing a second voltage to the second MEMS cantilever with a frequency substantially similar to $f_{res6}(1 + ab)$, wherein a is substantially similar to f_{res5}/f_{res6}, and f_{res5} is substantially similar to one half of at least one of a resonant frequency and a user-selected frequency of the first MEMS cantilever.

39. The method of claim 33, further comprising:

providing a first voltage to a first MEMS cantilever with a frequency substantially similar to at least one of a resonant frequency and a user-selected frequency of the first MEMS cantilever; and

grounding a second MEMS cantilever.

40. The method of claim 33, further comprising:

providing a first voltage to a first MEMS cantilever with a frequency substantially similar to at least one of a resonant frequency and a user-selected frequency of a second MEMS cantilever; and

grounding the second MEMS cantilever.

41. The method of claim 33, further comprising controlling a VLSI circuit fabrication process based at least in part upon measured oscillations.

42. The method of claim 33 employed to characterize a transistor.

43. A system for characterizing VLSI interconnect circuits, comprising:

means for positioning two or more MEMS cantilevers proximate to a pair of VLSI circuit interconnects without contact thereto;

means for injecting currents into the VLSI circuit interconnects *via* the MEMS cantilevers;

means for measuring oscillations on the MEMS cantilevers resulting from electrostatic forces generated upon injecting the currents; and

means for computing capacitance related to the VLSI circuit interconnects based at least in part upon the measured oscillations.

44. The system of claim 44, further comprising means for selectively injecting disparate currents into the VLSI circuit interconnects.

45. The system of claim 45, further comprising means for calculating capacitance based at least in part upon measured oscillations resulting from application of a plurality of disparate voltages.